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BACKGROUND PAPER

NUTRITION, MOTHER'S HEALTH AND FERTILITY:

THE EFFECTS OF CHILDBEARING ON HEALTH AND NUTRITION

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INTRODUCTION

1. Throughout the world, there is a fundamental concern with the widespread failure of the development process to reach the people most in need. There is a push among Governments and international agencies to treat the chronic problems of underdevelopment: disease, rapid population growth, malnutrition, illiteracy, underemployment and inadequate food resources.

2. Planners are beginning to realize that if they persist in attacking each problem in isolation, only limited progress can be made toward the common goal of all intervention programmes - improvement of the quality of life.

3. The aggregate is the job. Piecemeal efforts not only can fail to reach their short-term and long-term goals, but might even become counter-productive. Thus, reducing infant mortality through improved health and nutrition means more mouths for the family to feed immediately and more persons to house and clothe. Yet, merely reducing the numbers of births will not ensure the parents that their children will survive, nor make education accessible to the children.

4. Heretofore, attempts have concentrated on the separate symptoms rather than on the complexes in which the symptoms interact. Health, nutrition and fertility form an interacting complex that determines the well-being of the family. Programmes in each of these areas share the common goal of family well-being. Integrated efforts for programme promotion seem logical.

I. THE PROBLEM

5. Industrially developed countries have all attained low birth rates, a status gained via the well-known three steps of the demographic transition - high mortality and high birth rates; lowered mortality with continuing high fertility and consequent rapid population growth; and low fertility as well as mortality. It is generally accepted that countries now still in the first and second steps will eventually reach the third pattern in conjunction with improved literacy, standard of living and general development. The questions at issue are the time it will take, whether that time can be shortened and how it might be done.

6. Most of the less developed countries are not facing mere recapitulation of the history of the demographic transition. Their present circumstances differ with respect to factors such as already having achieved a large absolute population base and being exposed to pressures for rapidly closing the visible gap between themselves and more advanced countries. The answer seems to lie in telescoping the time span remaining before the end point of higher socio-economic status and slower population growth and bolstering the interval through world collaboration and support.

7. The interim should be a period of expanded education, health promotion, nutrition improvement and lower fertility. Such betterments derive from social sources combined with individual action, the latter especially prominent in people's dietary practices and fertility behaviour. At least, societies should give families the options for wholesome eating and for individual control of fertility. The topic of this paper is whether those two options can be made more accessible, acceptable and attractive by an integrated nutrition-fertility approach.

8. It is contended that nutrition intervention without fertility modification, or fertility modification without concern for nutrition, can have only limited success - that, in fact, such programmes may be scientifically questionable, socially unreasonable and programatically ineffective - even in short-range terms. Joint nutrition promotion and fertility modification programmes are essential. For the longer term, programme impact on the larger development goals may be far greater if the programmes are integrated from the start.

II. FERTILITY AS INSURANCE AGAINST CHILD LOSS

9. Social demographers (and others) have long believed that acceptance of family planning in developing countries will not occur until a significant reduction in infant mortality has been achieved. 1/ This "child survival hypothesis" states that once child loss rates decline, parents will perceive that fewer pregnancies are necessary to guarantee desired family size. If more children are surviving, the initial effect is increased family size and population growth. 2/ The theory postulates that in a later period, the population growth rate will decrease due to purposeful fertility control by the parents. This hypothesis must be tested on a large scale in order to identify the "time lag" from the achievement of rising infant and child survival to the lowered fertility rates associated with awareness of increasing family size. 3/

10. The implication of the child survival hypothesis is that programme intervention should proceed first from improved health and nutrition which will enhance survival chances, then with family planning education to make women aware that fewer pregnancies are possible and then to the offering of means of controlling unwanted pregnancies. Such a simplistic palliative is subject to two seemingly opposite criticisms, yet without disagreement with the basic importance of infant mortality in the total question. One is the obvious fact that mere excess of children over the family's capacity to care for them has not prevented marginal societies from having extremely high fertility. The key is not just awareness of the disadvantages of excessive family size, but the incompatibility between that situation and access to opportunity for the family's betterment. That opportunity must be real and visible. Among most deprived peasantry of the

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1/ Berg, A., The Nutrition Factor: Its Role in National Development, (Washington, D.C., The Brookings Institution, 1973): Freedman, R., The Sociology of Human Fertility, A Report and Bibliography, (Oxford, Basil Blackwell, 1963).

2/ Wray, J. D., "Will better nutrition decrease fertility?", paper presented at the IX International Congress of Nutrition; Symposium on Nutrition, Fertility and Reproduction, held at Mexico City, 3-9 September 1972.

3/ Omran, A. R., "Health benefits of family planning", Maternity-centred Family Planning Paper, (Geneva, World Health Organization, 1971); Taylor, C. E., "Health and Population", Foreign Affairs, April 1965, pp. 475-486; Taylor, C. E., "Five Stages in a Practical Population Policy", International Development Review, Vol. X, No. 4, pp. 2-7, 1968; Taylor, C. E., "Population trends in an Indian village", Scientific American, Vol. 223, No. 1, pp. 106-114, 1970; Taylor, C. E. and Hall, M., "Health, population and economic development", Science, Vol. 157, p. 651, 1967; Taylor, C. E., Newman, J. S. and Kelly, N. U., "Health aspects of population trends and prospects", United Nations document, E/CONF.60/CBP/26; Frederiksen, H., "Feedbacks in economic and demographic transition, Science, Vol. 166, pp. 837-847, 1969.

world, the family with three children is hardly less hungry than the neighbouring family with 10. Moreover, housing in the rural areas seems to have an inexhaustible capacity to absorb families as they grow. A strong element of social and economic improvement is an essential piece in the programme intervention mosaic. Research is needed to learn just how purposeful lowered fertility behaviour is and to understand the dynamic sequence of motivational change at different levels of deprivation and opportunity in relation to different risks of child loss.

11. The second and apparently opposite criticism contends that, without the need for a psychological or motivational explanation at the family level, it is infant mortality that shortens lactation, vitiates cultural taboos against abstinence and places women in a continuous state of reproductive effort. The very concept of protecting the pregnancy-free interval tends to disappear and the changed attitude spills over to encompass even a more fortunate surviving infant in need of care. Physiological elements of this picture and the nutritional implications will be considered at length later in this paper.

III. BASIC RELATIONSHIPS BETWEEN NUTRITION, HEALTH AND FERTILITY

12. The relationships between nutrition and fertility are interactive and cyclic. Therein lie the difficulties in attempting to delineate the direction of cause and effect and to measure discrete components in the complex interrelationships. Even in a simplified analysis, two directions must be considered and an attempt made to tease the elements apart - the effects of nutrition upon fertility and the effects of fertility upon nutrition. (See figure 1.)

A. THE EFFECTS OF NUTRITION UPON FERTILITY

13. Nutritionists have long studied and have produced a rich literature on the effects of a woman's nutritional status upon the likelihood of conception and the course and outcome of pregnancy. 4/ Serious complications of pregnancy, delivery and puerperium can be attributed to nutritional aberrations of women during pregnancy. 5/ Among the offspring, congenital malformations, birth weight,

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4/ Chopra, J. G., Camacho, R., Kevany, J. and Thomson, A. M., "Maternal nutrition and family planning", American Journal of Clinical Nutrition, Vol. 23, No. 8, pp. 1043-1058, 1970; Habicht, J. P., Yarbrough, C., Lechtig, A. and Klein, R. E., "Relationships of birthweight, maternal nutrition and infant mortality", Nutrition Reports International, Vol. 7, pp. 533-546, 1973; Hillman, R. W. and Hall, J. E., "Nutrition in pregnancy", chapter 39, Wohl, M. and Goodhart, R., eds., Modern Nutrition in Health and Disease, (Philadelphia, Lea and Febiger, 4th edition, 1968); "Nutritional Supplementation and the Outcome of Pregnancy", Proceedings of a Workshop, 3-5 November 1971 held at Sagamore Beach, Massachusetts, National Academy of Sciences, 1973; "Maternal nutrition and family planning in the Americas", Report of a Pan American Health Organization Technical Group Meeting, Scientific Publication No. 204, 1970; Siegel, E. and Morris, N., "Epidemiology of human reproductive casualties, with emphasis on role of nutrition", in Maternal Nutrition and the Course of Pregnancy (Washington, D. C., National Academy of Sciences, 1970).

5/ Berkner, L. and Susser, M. W., "Low birth weight and prenatal nutrition: an interpretive review", Pediatrics, Vol. 46, No. 6, pp. 946-966, 1970; Habicht, J. P., Yarbrough, C., Lechtig, A. and Klein, R. E., "Relation of maternal supplementary feeding during pregnancy to birthweight and other socio-biological factors", in Winick, M., ed., Nutrition and Fetal Development (New York, John Wiley and Sons, Inc., 1973); Rosa, F. W. and Tursben, M., "Fetal nutrition", Bulletin of the World Health Organization, No. 43, pp. 785-795, 1970; Lechtig, A. et al., "Influence of maternal nutrition on fetal growth in preindustrialized countries", Paper presented at Workshop on Latent Effects of Malnutrition and Infection during Pregnancy as Determinants of Growth and Development of the Child, held in Guatemala, 10-12 January 1974; St. George, J., St. John, E. H. and Josa, D., "Factors influencing birth weight in normal pregnancy", Journal of Tropical Pediatrics, September 1970; Yarbrough, C. et al., "Influence of gestational nutrition on birthweight and other outcomes of pregnancy, Paper presented at the 1973 American Public Health Association Meeting, held in San Francisco, California, November, 1973.

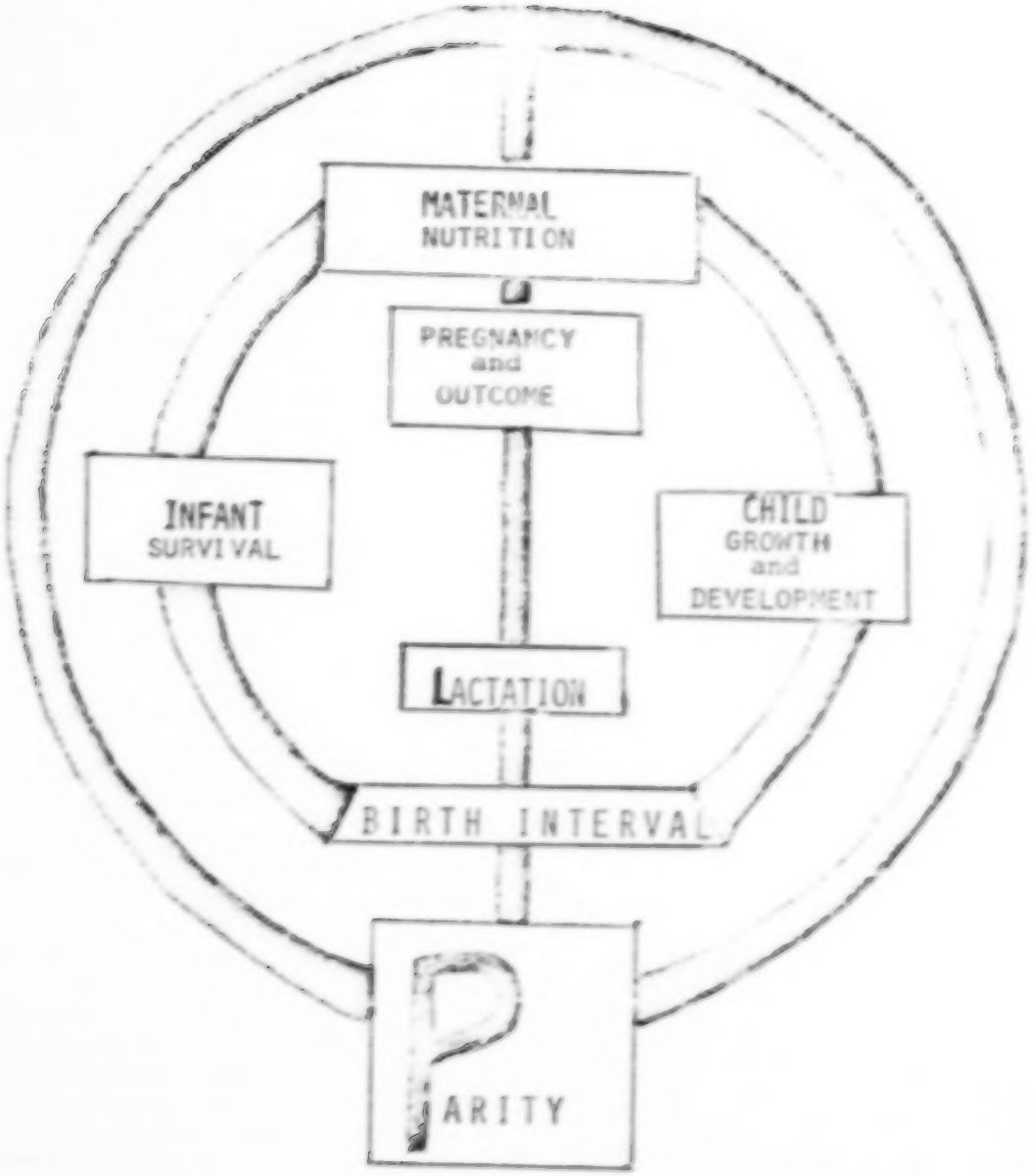

Figure 1. Basic relationship between nutrition and fertility

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constitutional strength, defenses against disease, growth and development and chance of survival may be modified by the mother's prenatal nutritional state. 6/

B. THE EFFECTS OF FERTILITY UPON NUTRITION

14. The focus of this paper is more on the opposite direction of the nutrition/fertility relationship: the question, "How does fertility - the frequency, timing and circumstances of childbearing - affect the nutrition of women and of their children and therefore their health and lives?" For this purpose, it is necessary to keep constant in the analysis the all pervading socio-economic determinants and also to raise certain still somewhat theoretical questions about women's variable physiological readiness to meet the physical demands of pregnancy and childbirth at different points in their childbearing years. The interplay between theoretical considerations and factual experience has implications for programme intervention.

C. PREGNANCY DURING THE POST-ADOLESCENT YEARS

15. With respect to the span of childbearing, possible instances of "excess fertility" might be expressed as: "too soon, too late and too many". "Too soon" refers to the post-adolescent overlap with pregnancy before the women has reached an age that may be optimum for childbearing. The unfavourable mortality and morbidity statistics among such young mothers and their children are evident for all times and places. These outcomes have been attributed to assumed endocrinologic and anatomical immaturity with respect to reproduction, coupled with the composite nutritional demands of continuing growth and pregnancy.

6/ Klein, R. E., Habicht, J. P. and Yarbrough, C., "Some methodological problems in field studies of nutrition and intelligence", in Kallen, D. J. D., ed., Nutrition, Development and Social Behavior, Proceedings of the Conference on the Assessments of the Tests of Behavior from Studies of Nutrition in the Western Hemisphere, (Washington, D. C., United States Government Printing Office, Department of Health, Education and Welfare Publication No. (NIH) 73-240, 1973); Lasky, R. E. et al., "The relationships between birthweight and psychomotor performance", Paper presented at Workshop on Latent Effects of Malnutrition and Infection during Pregnancy as Determinants of Growth and Development of the Child, held in Guatemala, 10-12 January 1974; Habicht, J. P., Lechtig, A., Yarbrough C. and Klein, R. E., "The timing of the effect of supplementation feeding on the growth of rural preschool children", paper presented at the IX International Congress of Nutrition, held at Mexico City, 3-9 September 1972. Albanese, A. A., ed., "The effect of maternal nutrition on the development of the offspring", United Nations, Protein Advisory Group Bulletin, Vol. III, No. 3, p. 38, 1973; United States National Center for Health Statistics, Infant Mortality Problems in Norway, (Washington, D. C., United States Department of Health, Education and Welfare, Public Health Service Publication No. 1000, Series 3, No. 8, October 1967).

16. That the phenomenon is not entirely physiological, however, is clear. Childbirth among women in their late teens is becoming progressively less hazardous in modernized countries. In less developed countries, on the other hand, the greater maternity risk below 20 years of age persists. 7/ The differences may reflect better obstetrical care as well as general socio-economic improvement. In a study 8/ done 30 years ago by one of the authors, in Hawaii of first births among the youngest group of mothers (15-19 years), comparison between those in and out of wedlock during the pregnancy revealed a three-fold differential in pregnancy wastage after the first trimester and a seven-fold discrepancy in their having obtained a reasonable minimum of antepartum care. The social definition of "illegitimacy" carried with it built-in barriers to health resources.

17. The problem is particularly applicable to less developed countries because of the earlier age of marriage and of first pregnancies that prevails. Not uncommonly, the extended family counts the months that elapse following a consummated alliance before a pregnancy proves the bride's worth. In some cultures, pregnancy is a precondition to marriage, just as it so often leads to marriages for legitimization in westernized societies. In the latter, added phenomena are the dramatic secular trend to earlier menarche and the tendency to earlier marriage and first birth among some groups in recent years. In any event and in all countries, the importance of giving special attention to the nutritional improvement of adolescent girls cannot be overemphasized. Policy and programme efforts must also devise effective ways of delaying the age of first pregnancy, ways that are culturally appropriate and societally feasible.

D. PREGNANCY DURING THE PRE-MENOPAUSAL YEARS

18. Similarly, at the other end of the childbearing years, the term "too late" refers to the contention that conception continues to occur past an age that is optimum for mother and child. There is no finding more consistent than the correlation of pregnancy complications and unfavourable outcomes with advanced maternal age. The hazards associated with premenopausal pregnancies are universally recognized.

19. This question of "too late" is closely tied to the problem of "too many", since the highest parity orders must cluster at the later years. Advanced age or high parity, each taken separately, adds risk; together, the jeopardy is compounded. 7/ A number of study findings on the dangers of high parity deserve

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7/ Jacobson, H. N., "Age-specific pregnancy risk", paper prepared for the Subcommittee on Fertility and Nutrition of the Committee of International Nutritional Programs, National Academy of Sciences, Washington, D.C., 1 March 1972.

8/ Wishik, S. M., "Study of utilization of health service by illegitimate young mothers", unpublished MS, Territory of Hawaii, Ministry of Health, Maternal and Child Health Division.

mention, although the separation out of interrelated variables such as age is not always satisfactory in the research designs. Women of higher parity are more prone to anemia 9/ and to lower weight-height ratio. 10/ Children in larger families, especially with more preschool age children, or of higher birth order, suffer more from malnutrition, grow more slowly, are more anemic, 11/ have impaired mental development 12/ and are offered diets that are poorer in calories and protein and that use less per capita expenditure. 13/ Admittedly, socio-economic differentials correlate with the higher parity and consequently with the greater frequency of unfavourable sequelae. 14/ How much does the disadvantage stem from parity and how much from economic deprivation? Some data on this will be given below. To some extent, it must be the combination that

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9/ Venkatachalam, P. S., "Iron Metabolism and Iron Deficiency in India", American Journal of Clinical Nutrition, Vol. 21, No. 10, pp. 1156-1161, 1968.

10/ Venkatachalam, P. S., "Study of diet, nutrition and health of the people of the Chimbu Area, New Guinea Highlands", Department of Public Health, Territories of Papua and New Guinea, Monograph No. 4, 1962.

11/ Bailey, K. V., "Synopsis of rural nutrition studies in Indonesia", Medical Journal of Australia, No. 14, pp. 669-676, May 1964; Wray, J. D. and Aguirre, A., "Protein-calorie malnutrition in Candelaria, Colombia. I. Prevalence; Social and demographic causal factors", Journal of Tropical Pediatrics, Vol. 15, No. 3, pp. 76-98, 1969; Rao, K. V. and Gopalan, C., "Nutrition and family size", Journal of Nutrition and Dietetics (India), Vol. 6, p. 258, 1969; Scrimshaw, N. S., Taylor, C. E. and Gordon, J. E., Interactions of Nutrition and Infection, World Health Organization Monograph Series No. 57, (Geneva, World Health Organization, 1968).

12/ Scrimshaw, N. S. and Gordon, J. E., Malnutrition, Learning and Behaviour, (Cambridge, Massachusetts Institute of Technology Press, 1968); Klein, R. E., Yarbrough, C., Lasky, R. E. and Habicht, J. P., "Correlations of mild to moderate protein-calorie malnutrition among rural Guatemalan infants and preschool children", to be published in Simposia of the Swedish Nutrition Foundation, Vol. XII, (Uppsala, Almqvist and Wilsells, 1974, in press); Wiener, G., Rider, R. V., Opperl, W. C. and Harper, P. A., "Correlates of low birth weight, psychological status at eight to ten years of age", Pediatric Research, Vol. 2, pp. 110-118, 1968.

13/ Levinson, F. J., The Effects of Income Change on Food Consumption in South India and Ceylon, (Ithaca, New York, Cornell University Press, 1970); Lechtig, A. et al., op. cit.

14/ Schultz, P. T., Determinants of Fertility: a Micro Economic Model of Choice, (New York, St. Martin Press, to be published by the International Economic Association, 1974); Wray, J. D. and Aguirre, A., op. cit.

constitutes the offending agent. Figure 2 shows that when the high pregnancy wastage rates in many less developed countries are compared with the loss rates in the more favoured countries, the U-shaped curve becomes shallower as well as lower. 15/ The extra jeopardy, especially at the upper end, is reduced.

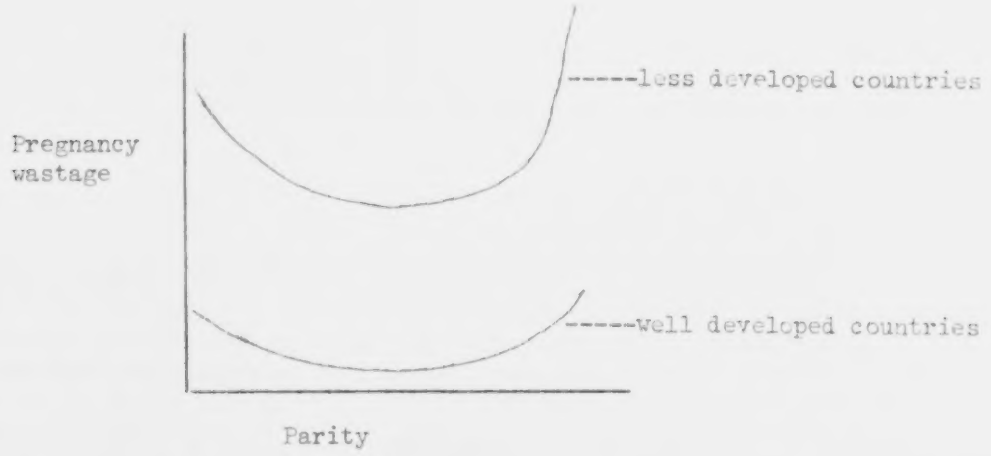

Figure 2. Pregnancy wastage rates

15/ Wyon, J. B. and Gordon, J. E., "A long-term prospective type field study of population dynamics in the Punjab, India" in Kiser, C. V., ed., Research in Family Planning, (Princeton, New Jersey, Princeton University Press, 1962); Potter, R. G., Wyon, J. B., New, M. and Gordon, J. E., "Fetal wastage in eleven Punjab villages", Human Biology, pp. 262-273, September 1965; Wray, J. D. "Population pressure on families: family size and child spacing", chapter II in Revelle, R., ed., Rapid Population Growth: Consequences and Policy Implications, (Baltimore, The Johns Hopkins Press, 1971); Wishik, S. M. and Stern, R. G., "The impact of birth spacing in maternal and child nutrition", Ecology of Food and Nutrition, 1974, in press; Jelliffe, D. B. and Jelliffe, E. F. P., "An overview. Symposium on the uniqueness of human milk", American Journal of Clinical Nutrition, Vol. 24, No. 8, pp. 1013-1024, August 1971.

20. The lessons are clear. Health and nutrition of mothers at the upper end of the childbearing years or of parity order need special protection as long as complete avoidance of pregnancy is not assured at those ages. The goal of contraceptive protection in these groups of women would seem to be a reasonable concurrent target. In the large majority, these women have attained or exceeded their desired family size. They are not expected or required by the family to produce more offspring nor is their hierarchical status dependent on continued childbearing. Many a woman is ready to settle into an abstinence relationship with her husband if permitted and even welcomes or encourages other sexual outlets for him, such as in concubinage and prostitution. The pressures to such alternatives with possible or at times implicit social dislocations might be lessened by fuller access to acceptable and reliable contraception. For the older age groups, surgical sterilization is an obvious solution that warrants emphasis in fertility modification programmes.

E. CLOSE BIRTH SPACING

21. To the possible fertility excesses thus far discussed must be added that of "too close together". Birth spacing can be looked at in terms of the three major components of the "closed interval" between successive pregnancies, as shown in figure 3.

22. Recent thinking rejects the traditional concept that pregnancy constitutes a stress upon the woman's usual physiology similar to the effect of disease. Rather, the position is held that a woman adjusts to a new physiology involving herself, the foetus and the placenta. These pregnancy-related physiologic changes must be reversed after delivery through a process of readjustment. In general, the readjustment seems to be a fairly prompt response to the restored hormonal balance after delivery. On teleological grounds, this is not surprising; one would expect that reverse adjustment in the healthy postpartum woman would be reasonably complete in time for the next pregnancy. Overlap between incomplete restoration and a succeeding pregnancy is by definition undesirable. This situation could result from delay of the former and/or failure to respect the "natural" interval between pregnancies.

23. The interval between pregnancies consists of parts b and c in figure 3, the pregnancy-free period before and after the postpartum return of ovulation. In comparison with the state that prevailed among earlier societies, these two parts of the "natural" interval are being shortened first by replacing the breast-feeding of infants with artificial feeding, 16/ thus reducing the effect

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16/ Jelliffe, D. B. and Jelliffe, E. F. P., op. cit.; Latham, M. D., "Conclusions and recommendations on lactation in relation to steroid contraceptives and fertility", draft of position paper prepared for the Subcommittee on Nutrition and Fertility of the Committee on International Nutrition Programs, National Academy of Sciences, Washington, D.C., 1 March 1972; Brown, R., "Promotion of breastfeeding and breastfeeding in modern times", American Journal of Clinical Nutrition, Vol. 26, pp. 556-562, 1973; Harfouche, J. K., "The importance of breastfeeding", Journal of Tropical Pediatrics, pp. 135-175, September 1970.

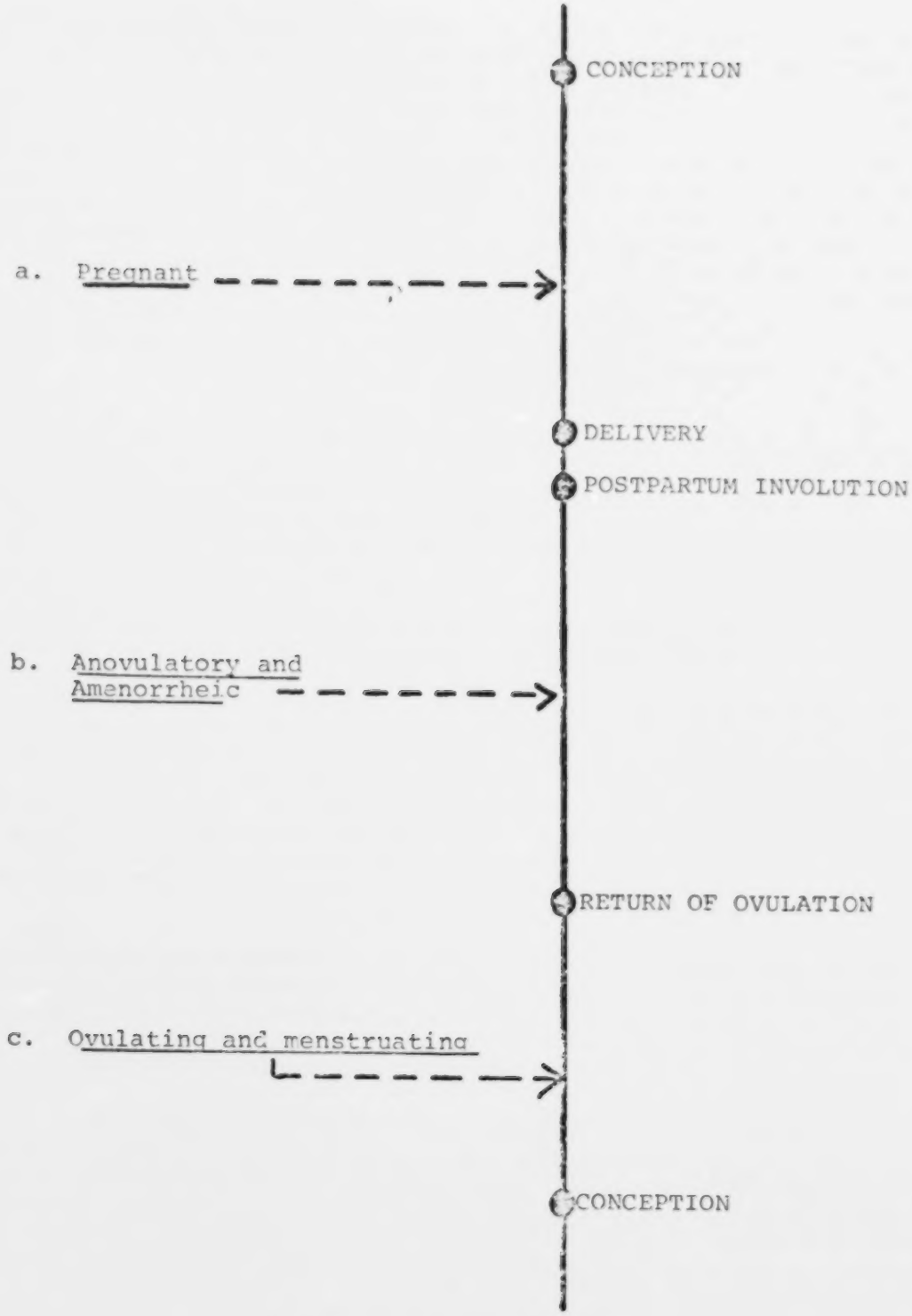

Figure 3. The fertility cycle

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that lactation has in delaying the return of ovulation. 17/ Secondly, cultural taboos against postpartum sexual intercourse are being weakened. Both developments are widespread concomitants of the urbanization and industrialization that accompany rapid population growth in less developed countries. The total interval between conceptions is further shortened by abortions and miscarriages and by foetal and early infant deaths, with removal of need for breast-feeding.

24. Data are beginning to accumulate on the undesirability of very short interbirth intervals. 18/ This substantiates the same almost worldwide belief among earlier societies. Peoples in parts of Africa and other places have in their languages a word to denote the incompatibility (mutual poisoning) between the baby at the breast and the one growing in the womb.

25. The question is a difficult one to prove. Often, the reported interbirth interval disguises unidentified interrupted pregnancies that produce inverted paradoxical correlations. Recent studies have also been more successful than earlier ones in allowing for socio-economic class differences that confer common and parallel effects upon fertility behaviour, nutrition, health and survival. 19/

26. The "normal" interbirth interval of earlier societies that would result from a term pregnancy (nine months) plus the anovulation of full breast-feeding (six to nine months or more) plus abstinence (another 15 months) equals 2.5 to 3 years. To a healthy woman living under favourable conditions, a shorter interval than this may not be threatening. For less healthy women in poverty and under other environmental stresses, what may have otherwise been a physiologically permissible interval becomes "too short".

27. Programme efforts must aim at maintaining a safe interval. To avoid shortening of component a, gestation, the need is for better nutrition before and during pregnancy and for selective focused antepartum health supervision and care. To prevent shortening of component b, the anovulatory period, the need is to assure a surviving infant through its health and nutritional protection, through educational campaigns on the benefits of breast-feeding directed at countering commercial pressures toward artificial feeding, and through government policy and programmes that affect the employment roles of women and enhance the opportunities for mothers to remain with and care for their nursing infants.

17/ Potter, R. G. et al., "Applications of field studies to research on the physiology of human reproduction: lactation and its effects upon birth intervals in eleven Punjab villages, India", Journal of Chronic Diseases, Vol. 18, pp. 1125-1140, 1965; Salber, E. J., Feinleib, M. and MacMahon, B., "The duration of postpartum amenorrhea", American Journal of Epidemiology, Vol. 82, No. 3, pp. 347-358, 1965.

18/ Wolfers, D. and Scrimshaw, S., An Analysis of Birth Intervals and Mortality, (in preparation at the International Institute for the Study of Human Reproduction, Columbia University, New York); Lichtblau, N., "Interactions between nutrition and fertility variables in survey data as derived from formulations concerning dependency relationships", paper presented at the Annual Meeting of the American Public Health Association, San Francisco, California, November 1973.

19/ Bailey, K. V., op. cit.; Lichtblau, N., op. cit.

To prevent shortening of component c, the ovulatory period, access to effective contraception is the modern equivalent to postpartum cultural taboos. The associated need is for nutritional protection of nursing mothers and of young children, at least through the post-weaning period. (See figure 4.)

28. Two different sets of hypotheses can be held with respect to the impact upon a given index child of the length of interbirth interval, according to whether the interval under assessment preceded or followed his birth. With a base of the total pregnancy history of his mother, and working backward from his birth, one is concerned with the course of the pregnancy during his intra-uterine residence, his mother's health and environmental stresses during the pregnancy-free interval between his birth and that of his older sibling, the length of that interval, the occurrence of lactation during it and the nature of and sequelae from that earlier pregnancy. Working forward across the interval that followed his birth, on the other hand, one must again include his mother's experience during his embryologic and foetal development, his birth and postpartum course, whether he was breastfed, his subsequent diet and illnesses and the span of time before his mother conceived again. The pregnancies on both ends of the interval under analysis as well as the events during that interval enter into the weighting.

29. Although the mother's full pregnancy and health history is relevant, we have arbitrarily chosen to focus on the proximate three-year and five-year periods for intensive quantitative analysis and have developed a number of indexes called Fertility Burdens. 20/ These constitute bases for classification and statistical comparisons among groupings of women and their children. The indices are under continuing validation. They are:

(a) gestation burden; the number of months of pregnancy, weighted by trimesters of pregnancy;

(b) lactation burden; the number of months of lactation, weighted by proximity to delivery and extent of supplementation of the infant's diet;

(c) gestation/lactation burden;

(d) child caring burden: the number of child-years among the siblings during the interval under analysis, weighted by ages of the children;

(e) family food consumption burden; the number of family members, weighted by age and sex.

Work is also in process on improving health and socio-economic indices suitable for such studies.

20/ Wishik, S. M., Fertility Burdens, (work being done at the International Institute of Human Reproduction, Columbia University, New York, 1974).

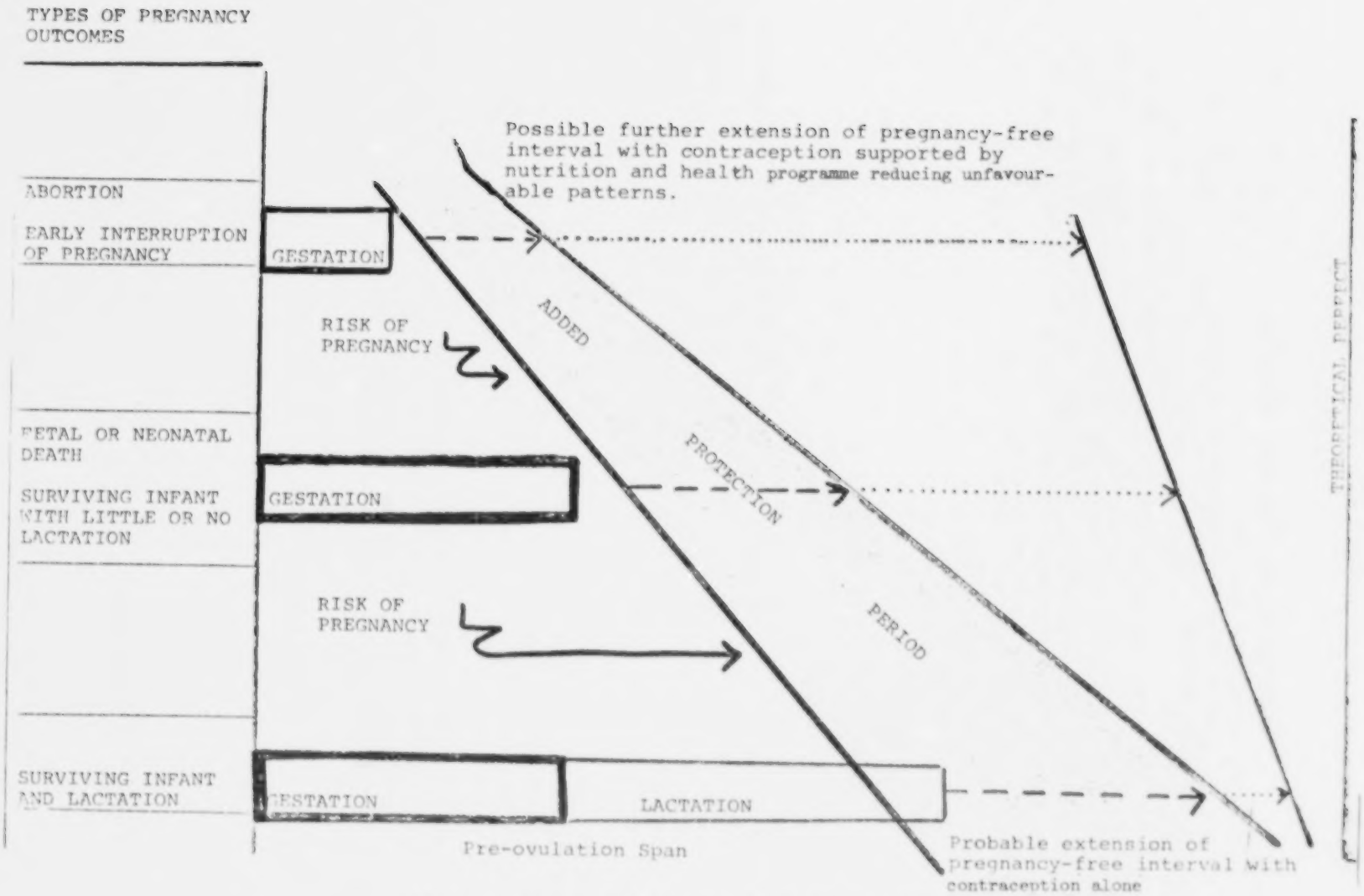

Figure 4. Theoretical patterns of interbirth intervals

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30. Findings indicate that interbirth interval, as measured directly and also as manifested indirectly in women's age-specific parity, correlates significantly with the probability that their young children will achieve better growth and development and nutritional state. 21/

31. Of course, age-specific parity is largely a reflection of spacing. Direct measurement of birth interval also reveals very interesting and important health relationships. Women whose birth intervals fall at or below two years are not likely to have better nourished children. At higher parity, it takes an interval of almost three years for the children to have a reasonable chance for adequate nutritional state in generally deprived populations. 21/

21/ Lichtblau, N., op. cit.

IV. IMPLICATIONS FOR PROGRAMME INTERVENTION

32. The need for a combined approach to achieve the dual objectives of improved nutrition and modified fertility emerges clearly when findings and trends are simulated in different hypothetical communities. 22/

33. The following table presents these cyclic interactive relationships among maternal nutritional status, fertility patterns and behaviour, child health, survival, growth and development, in four types of communities.

(a) Community O is a deprived population. Mothers are on inadequate diets and their fertility is uncontrolled. Since maternal nutrition is poor, mothers will be more vulnerable to unfavourable pregnancy outcomes and interrupted pregnancies. Despite fairly adequate lactation performance, these mothers will still have high infant losses which shorten the interbirth interval. Eventually, higher parity will result. The combined cyclic interactions adversely affecting pregnancy wastage, maternal nutrition, chances of infant survival, child growth and development and maternal longevity will persist.

(b) In Community A, diets have been effectively modified. Maternal nutritional status should improve and pregnancy outcomes should be more favourable. However, if fertility remains uncontrolled, mothers for parts of their child-bearing years remain in risk categories that enhance pregnancy wastage and infant loss. Secondary results would be shorter than desired birth intervals, high over-all parity and possibly reduced maternal longevity. Furthermore, among surviving pre-school children, growth and development may be retarded.

(c) In Community B, effective fertility modification has been introduced. If only the fertility factor is "effectively" controlled, maternal nutrition and its sequelae would not be corrected. As a result, pregnancy wastage remains high as in Community O, and leads to shortened birth intervals and sequelae despite effective contraception adoption.

(d) Community AB has an effective combined diet and fertility modification programme. This is the only approach that breaks through these interrelated cyclic phenomena and theoretically permits the attainment of positive results in all the categories listed, as demonstrated by the series of all plus signs in this column.

22/ Wishik, S. M. and Van der Vynckt, S., Uncontrolled Fertility and Malnutrition, (Washington, D.C., National Academy of Sciences, 1974).

Expected Status in Comparison with Acceptable Levels

	COMMUNITY O DEPRIVED POPULATION	COMMUNITY A EFFECTIVE DIET MODIFICATION	COMMUNITY B EFFECTIVE FERTILITY MODIFICATION	COMMUNITY AB EFFECTIVE DIET AND FERTILITY MODIFICATION
MATERNAL NUTRITION	Poor −	Normal +	Poor −	Normal +
↓ PREGNANCY COMPLETION CHANCES	Poor −	Normal +	Increased −	Normal +
↓ LACTATION COMPETENCE	Adequate +	Normal +	Adequate +	Normal +
↓ INFANT SURVIVAL CHANCES	Poor −	Increased ±	Poor −	Normal +
↓ BIRTH INTERVAL	Short −	Shortened ±	Shortened ±	Prolonged +
↓ FERTILITY RATES	High −	High −	Reduced +	Low +
↓ TOTAL PREGNANCY WASTAGE	High −	Reduced ±	Reduced ±	Low +
↓ FAMILY WELFARE	Poor −	Fair ±	Poor −	Improved +
↓ CHILD GROWTH AND DEVELOPMENT	Poor −	Normal or Increased ±	Poor −	Normal +
MATERNAL LONGEVITY	Poor −	Increased ±	Poor −	Normal +

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V. CONCLUSION

34. Because of the essential interdependence of fertility modification and nutrition promotion in achieving their common goals of better family health and welfare, it is recommended that integrated public programmes be established. Information on the bases for the conjoined attack should be disseminated widely.

35. Intervention programmes should include experimental and control populations in several countries that together represent a reasonable spectrum of levels of development. A common evaluation system with appropriate country adaptations should be built into the project.

36. Allowing for a planning and development period of two years, the prospective span of the project should begin to show results in three years and clearly in five.